2018 ICTP/ICO Prize Winner Urbasi Sinha Promoting Quantum Science and Technology in India

In India, she created and leads the country's first laboratory dedicated to research in quantum optics, directing ground-breaking research in quantum information and computing. Her research achievements, combined with her active promotion of optics research to the general public, have earned Urbasi Sinha the 2018 International Commission for Optics(ICO)/ICTP Gallieno Denardo Award.

The optics prize is awarded annually to researchers younger than 40 years of age from a developing country who have made significant contributions to the field of optics or photonics. Sinha was presented with the award at a ceremony held at ICTP on 13 February, during the Centre's annual Winter College on Optics.

At her Quantum Optics Laboratory based at the Raman Research Institute in Bengaluru, India, Sinha has been investigating new frontiers in the world of quantum optics. Her experience in the field prepared her well for the pioneering role she now finds herself in. Educated at Cambridge, she spent several years at Canada's Institute for Quantum Computing (IQC), where she was encouraged by IQC Founder and Director Raymond Laflamme (a student of Stephen Hawking) to perform experiments in IQC's quantum optics lab. "I wanted to learn quantum optics by experimentation, and this was one of the best environments to do that in," Sinha explained. One of her first experiments there was to test a key concept of quantum mechanics known as Born's rule (a rule that predicts the probabilities for occurrence of events) but had, until then, never been explicitly tested. The results of that experiment, summarized in an article with Sinha as lead author and Laflamme and others as co-authors, proved the validity of Born's Rule and received broad media coverage after it was published in *Science* magazine in 2010 (10.1126/science.1190545).

Back in India, Sinha's lab is pursuing several research lines, providing valuable hands-on experience to the many students who are keen to work with a scientist of Sinha's international stature. "Quantum information is a very new area in India, especially experimental, and ours is one of the first modern labs to be dedicated to this field," she said. One activity at the lab is investigating a higher dimensional system--a unit of quantum information--called a qutrit. "This is an alternative approach to trying to increase the number of qubits in a quantum computer, which is what most people are trying to do," Sinha explained, referring to technology giants like IBM and Intel who are in a race to produce quantum computers with 50 qubits.

Other research lines include quantum entanglement and quantum key distribution. The latter, explained Sinha, will play an important role in information security once quantum computers become a reality. "The problem is that a quantum computer is going to be able to run an algorithm which can break the classical key distribution, called Shor's Algorithm, that is used for encryption and decryption. So, we need a quantum answer to the question."


International Commission for Optics
Commission Internationale d'Optique
ICTP
the Abdus Salam
International Centre
for Theoretical Physics
ICO and ICTP PRESENT THE 2018
ICO/ICTP GALLIENO DENARDO AWARD
to
Urbasi Sinha
for her pioneering research in photonic quantum technologies,
contributions to cutting edge experimental research in quantum optics,
and extensive and multifaceted outreach activities towards popularizing experimental optical science in India
Trieste, Italy
13 February 2018
for the Chair of the Prize Committee
Miltcho Danailov
The ICO Representative
Roberta Ramponi
The ICTP Representative
Joseph Niemela